

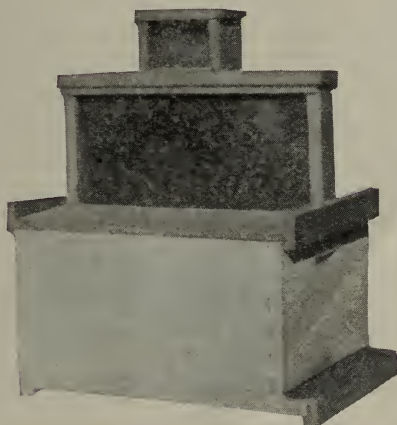
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HOW TO MAKE AN OBSERVATION HIVE

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For nature-study the honey-bee offers exceptional advantages. In its anatomy one can find numerous structures especially fitted to its peculiar habits. The colony-life of honey-bees is an example of perfected coöperation including many things which might well be applied to improve our own scheme of life. The purpose of this circular is to aid the student to a better understanding of these things by bringing the bee colony into the school room where he may be enabled to discover the manner of life of honey-bees for himself. (Some manual training teachers desire to correlate the work of their pupils with gardening and nature-study in elementary schools or with general science and agriculture in high schools. It is hoped that the drawings and specifications reproduced in this publication will be of service in this connection.—E. B. B.)

Before attempting to carry out the plans given below it is very desirable to read some standard book on bee keeping. A list of such books is found at the end of this circular.

An observation bee hive is constructed of wood and glass, so arranged that one may easily see the insects housed therein. Many different styles have been devised, and whether crude or elaborate, all are successful, providing they fulfill the conditions which the bees demand in the construction and maintenance of their colony.

It has seemed very desirable to keep the bees, as nearly as possible, under natural conditions, that is, similar to the condition of a hive in the apiary. This necessitates a few simple manipulations of the bees; these, however, are operations which every beginner in apiculture should become acquainted with. In design the apparatus described below is simple enough so that one little skilled in the use of tools may readily construct it.

To best meet these conditions the observation hive here described is built upon an ordinary Langstroth hive cover and is used in connection with a common frame body. This allows two plans to be followed: one may buy the hive complete (price about \$2.00) and modify the cover or construct the apparatus entire from the plans herein presented, which give all the necessary dimensions. The second suggestion can be followed in any school where there is a manual training department.

The observation portion of the hive in which the queen is kept is separated from the brood chamber or lower story under the cover in figure 3. This has a three-fold purpose. First, to limit the operations of the queen; second, to allow of having a large number of bees at hand to keep the frame well stocked; third, and most important, besides letting the bees pass in and out freely, the temperature of the observation section is raised by the mass of bees underneath. This is a point neglected in most glass hives. The large surface offered for radiation and the smallness of the colony tend to cause an abnormal death rate, and a lessened intensity of the activities within.

The best general idea of the hive can be obtained from the cut upon the first page and figure 4, which suggests a method of installation for the classroom or any indoor situation.

Figures 1 and 2 show a standard bee hive in general use by bee keepers throughout the United States. Different manufacturers produce the Langstroth hive with modifications in the cover and bottom board, but the inside dimensions are constant and all parts are absolutely interchangeable. A hive proper consists of a body of brood section measuring on the inside $18\frac{1}{4}$ inches long, $14\frac{1}{4}$ inches wide and $\frac{5}{8}$ inches in depth; this contains 10 frames 17 inches long, 8 inches deep and $\frac{7}{8}$ inches wide to support the comb. These are spaced

half an inch apart and are adjusted by the fingers. Self spacing frames are sometimes used but cannot be so readily handled. For the storage of honey a supplementary body of super may be added. In the two plates a honey section super is shown. If extracted honey is desired a section like the brood chamber replaces this. These are removed or extracted as soon as filled by the bees. A bottom board furnishes the floor, body, super and cover. They may be hooked if necessary. In both plates the interior is shown upon the left, the crooked lines represent breaks in the exterior surface, which is represented on the right.

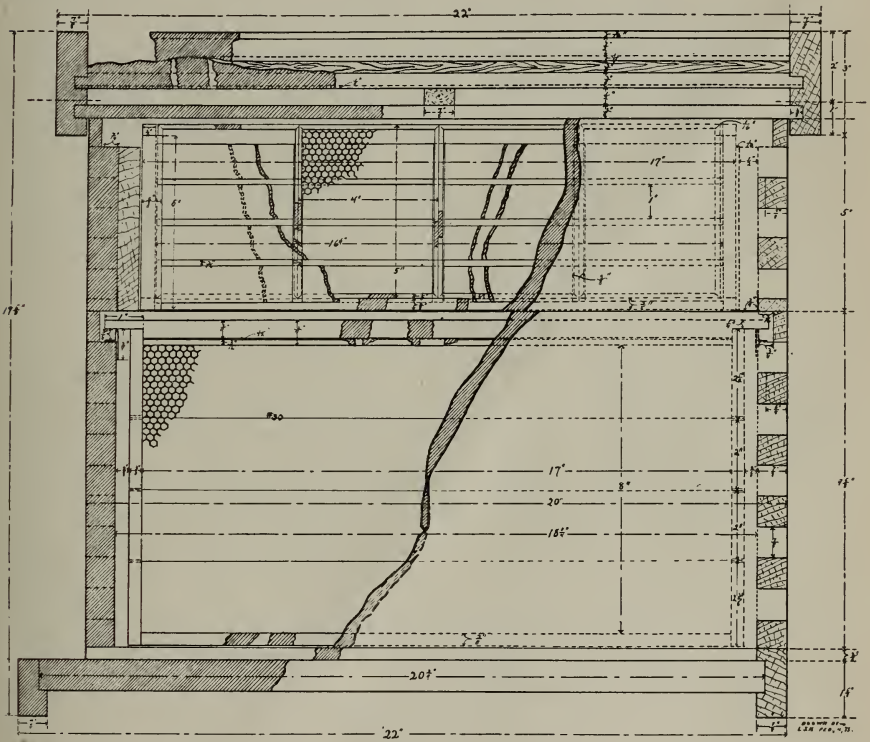


Fig. 1

Sugar pine is the most satisfactory material to use for the various parts. If it is intended to have the hive set upon the ground, bottom board and cover had best be made of redwood. All outside surfaces should be painted. All parts except the cover are nailed; eight penny nails are best for the heavy parts; light shingle nails (3d fine) for the frames. For portions of the honey super and most of the observation

section one should use $\frac{3}{4}$ inch brads. In all the work the parts should be planed smooth.

THE BOTTOM BOARD.

The bottom board consists of six pieces of wood. The floor boards are $20\frac{3}{4}$ in. x $\frac{7}{8}$ in., one 8 in. wide, the other $8\frac{1}{4}$ in. wide. A tongue and groove must be cut on the inner edges, making the boards the same width on the surface.

The cleats are four in number, two end cleats and two side cleats. For the side cleats strips of wood $19\frac{7}{8}$ in. x $\frac{7}{8}$ in. x $\frac{3}{4}$ in. are sufficient. The ends are a little more elaborate, the back cleat is 16-in. x 2 in. x $\frac{7}{8}$ in. with a slot $\frac{7}{8}$ in. x $\frac{1}{4}$ in. cut $\frac{3}{8}$ in. from one edge. The front cross piece is smaller to allow for an entrance, it is 16 in. x $1\frac{5}{8}$ in. x $\frac{7}{8}$ in. with a $\frac{7}{8}$ in. rabbit cut in one edge. The bottom board is made 2 in. longer than the hive, producing an alighting place at the entrance. Six nails are sufficient for each end. Five shingle nails may be used for each of the side cleats. This portion is often left unpainted, but a good coat of paint will add years of life, greatly improve the appearance, and materially aid in cleaning this portion of the hive.

THE BROOD SECTION.

The brood section is made of four pieces of wood and two pieces of metal called T tins. The latter are necessary to prevent the base from sticking the frames to the body with propolis or bee glue. The end pieces are 16 in. x $9\frac{5}{8}$ in. x $\frac{7}{8}$ in. Rabbits $\frac{7}{8}$ in. x $\frac{3}{8}$ in. are cut in one corner of the 16 in. width; make hand holes $4\frac{1}{2}$ in. x $\frac{7}{8}$ in. x $\frac{5}{8}$ in. upon the opposite side $1\frac{3}{4}$ in. from the rabbit end. On either end $\frac{7}{8}$ in. x $\frac{7}{8}$ in. dove tails are cut. To support the frames in the rabbit a piece of tin 14 in. x $1\frac{1}{2}$ in. is used. This is bent as shown in the drawing, i.e., a $\frac{3}{8}$ in. portion is turned up at right angles and then the strip is double dupon itself.

The sides are plain boards 20 in. x $9\frac{5}{8}$ in. x $\frac{7}{8}$ in. with dove tailing on both ends. Care should be used in marking out the dove-tails, these are $\frac{7}{8}$ in. x $\frac{7}{8}$ in.; the bottom corner is cut out and the top only $\frac{1}{2}$ in. deep. Alternate tails should be nailed beginning at the upper corner of each end piece. Paint the outside only.

THE FRAMES.

The frames are built up from five strips of sugar pine and are ten in number. An extra one is also made for the observation section. The parts of the frame are called bars, i.e., top bar, bottom bar and

end bars. The bottom bar is 17 in. x $\frac{3}{8}$ in. scant x $\frac{7}{8}$ in. and the end bars,—two to each frame—are $8\frac{7}{8}$ in. x $\frac{3}{8}$ in. scant x $\frac{7}{8}$ in. The top bar is $18\frac{3}{8}$ in. long x $\frac{7}{8}$ in. wide and $\frac{3}{4}$ in. deep. The ends are cut away, leaving projections 1 in. x $\frac{1}{4}$ in. to support the frame upon the T tins, which in turn are nailed to the body. On the lower side a $\frac{7}{16}$ in. x $\frac{1}{4}$ in. rabbit is cut and the projecting outside edge is beveled down $\frac{1}{8}$ in. To fit in the rabbit, a narrow strip is cut $\frac{7}{16}$ in. x $\frac{1}{4}$ in. and the flat side beveled to leave $\frac{1}{16}$ in. on the narrow edge and $\frac{3}{16}$ in. on the flat side. This corresponds with the beveling on the top bar. The use of this strip will be explained a little later.

When fastening the frame parts, two nails should run through the top bar into the end bars and one from the end bar into the top bar. Two nails through each end bar will support the bottom. In the end bars one should drill three holes, $\frac{1}{16}$ in. in diameter, spaced as shown in figure 1. Through these No. 30 wire should be run, threading through from the right hand top hole back and forth to the lower left hand bottom hole. The wire must be fastened with a small tack at each end.

Upon the wires and in the rabbit of the top bar is fastened a sheet of comb foundation. This is a sheet of wax with the imprint of the cell bases pressed upon it, greatly aiding the bees in starting their cells and constructing them in even rows. To fasten in the foundation, it should be slipped under one wire and over another, pressed firmly in the rabbit of the top bar and the small strip nailed securely upon it. Five small flat headed brads should be used for this. When the foundation is fastened at the top a spur-imbedder should be run over the wires to impress them into the foundation to keep it from sagging.

Eleven of these frames should be prepared, ultimately to take the arrangement pictured in figure 2.

THE SUPER.

The super is intended as a storage place for surplus honey. Figure 1 shows its somewhat complicated structure. Trays of sections are separated by a 'fence,' each alternating, a 'fence' on either extreme. Figure 2 shows this. In figure 1 a section of comb is shown in the super; on either side are two sets of broken lines. These represent breaks in the fence to show the honey sections which in this side view of the hive would be covered by them.

Before constructing the super, it would be best to make a working

drawing of each part, viz., the super, moveable end boards, section trays, fence, honey sections and tin supports.

The super proper is a half-depth hive body. It is composed of

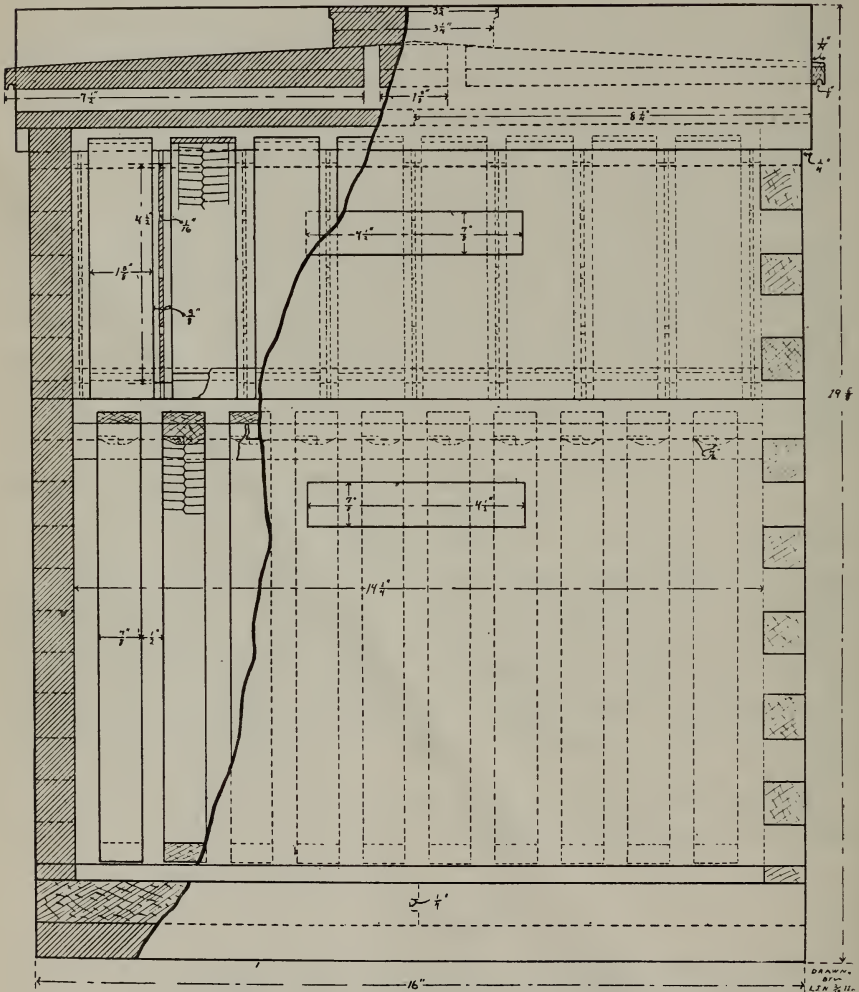


Fig. 2

four pieces of wood and two strips of tin. In construction it is a duplicate of the bottom section except that the depth or width of the boards are 51 1/2 in., necessitating a narrow dovetail at the bottom. To support the section trays and fences, angles of tin are used. A strip 14 in. long and 1 1/2 in. wide bent at right angles giving 3/4 in. to each

face is sufficient. These are nailed upon the inside of the super at the bottom. Upon completion the outside of this part should be given a coat of paint.

The end boards are two in number, $14\frac{1}{4}$ in. x $4\frac{5}{8}$ in. x $\frac{1}{2}$ in. and finished smooth. These are removeable and serve to fill up the space left by the short honey section trays. For larger sections, a little longer tray would be used, making the end board unnecessary.

The honey section trays take the form of a very wide U and are made up of three pieces of wood, i.e., two end bars and one bottom bar. The end bars are 5 in. x $1\frac{3}{8}$ in. x $\frac{1}{2}$ in. scant and the bottom bar 17 in. x $1\frac{3}{8}$ in. x $\frac{3}{8}$ in. They set upon the bottom bar and are nailed flat through it, using three nails (3d fine).

The 'fence' is a small slatted partition to separate one tray from another and to allow the bees to enter the honey sections and deposit their stores. Both the partitions and the sections are made from bass wood. These can be purchased for a few cents from any bee supply dealer and it is best to attempt to make them. If one desires to make the fences, either bass or some close grained soft wood, such as maple, should be selected; twelve pieces of wood are necessary. Two grooved uprights for ends hold four horizontal parallel slats which in turn have a narrow upright, on either side, opposite the perpendicular parts of the honey sections, making six of these for each frame or three to a side. The end pieces are $5\frac{1}{8}$ in. x $\frac{5}{8}$ in. with a $\frac{3}{16}$ in. x $\frac{1}{16}$ in. slot cut in the middle of one $\frac{3}{8}$ in. face. In all, one will need 18 of these end pieces. Each slat of the fence is $16\frac{1}{4}$ in. x 1 in. x $\frac{1}{16}$ in. apart and an equal distance from the ends of the end grooved supports. Thirty-six slats furnish enough material for the nine fences. The little uprights which are nailed to the slats are $4\frac{1}{2}$ in. x $\frac{1}{4}$ in. x $\frac{5}{32}$ in. Fifty-four of these small pieces are required. Use $\frac{1}{4}$ in. small flat-headed brads to nail fence together. Bee keepers know this style of fence as the M-fence. Where this style of fence is used the honey sections are plain, that is, they have no bee way. Their dimensions are 4 in. x 5 in. x $1\frac{3}{8}$ in. When ordering sections from the dealers specify "no bee way" and give dimensions. It is not wise to attempt to make the sections. Sections come flat. Wet them before bending into shape to prevent breaking at the corners.

As set up the observation hive would not use the super in connection with it unless the bees become very short of storage room. The constant disturbance of the bees make the production of a surplus of honey very doubtful; in any case it should be saved to feed the colony during the winter.

THE COVER.

The roof for the hive shown is a ventilated gable cover. In practical apiary work this style is not as much used as the plain cover due to the fact that ants, spiders and often wax moths collect in the open portion. The upper part of the cover is the same, whether we wish a ventilated or unventilated cover. The difference is brought about by making the end cleats 2 in. wide instead of 3 in. The change is indicated by the dotted line in figure 1. This allows the top part of the cover to rest upon the hive, dispensing with the air space feature.

From the drawing one can gain a sufficient idea of the ventilated type of top for this hive.

The usual kind of gable cover is composed of six parts of wood, viz., two end cleats, two beveled boards to make the slope of the roof, a top cleat, and a lower bar to support it.

The top cleat and support need not be made if one is constructing an observation hive.

For the end cleats of the cover two parts of wood are needed, $16\frac{1}{2}$ in. x 2 in. x $\frac{7}{8}$ in. in dimension; a $\frac{3}{8}$ in. slot is cut $\frac{3}{8}$ in. from one edge to hold the two main boards of the roof. These are $20\frac{3}{4}$ in. x $7\frac{1}{2}$ in. x $\frac{7}{8}$ in. A rabbit $\frac{1}{2}$ in. x $\frac{5}{16}$ in. should be cut on each end, leaving a $\frac{3}{8}$ in. x $\frac{5}{16}$ in. projection to fit into the end cleats. Make two of these parts. When the rabbit is cut bevel the boards leaving them $\frac{7}{8}$ in. on one edge and $\frac{3}{8}$ in. upon the other. Cut a groove $\frac{1}{8}$ in. in width, $\frac{1}{16}$ in. from the lower, outer edge. This prevents rain water running into the hive.

The top cleat is 20 in. x $3\frac{1}{2}$ in. x $\frac{7}{8}$ in. rabbitted on both sides to shed water and hollowed out slightly underneath to fit over the slope of the cover. The lower bar is $20\frac{3}{4}$ in. x $1\frac{3}{8}$ in. x $\frac{7}{8}$ in. rabbitted to fit the end cleats. Nine nails will hold the ends; two for the top bar, three for either side and one in the middle. Six small nails should fasten down the center top board to the side slopes. Paint only the upper side of the cover.

If a hive is kept in a class room, the observation cover should be removed at vacation time and a simple one, described above, substituted.

THE OBSERVATION COVER.

Omitting details, the observation device consists of two uprights screwed to the cover and cleats. These are grooved to hold two glass plates. Over this is placed a cover upon which is fastened a feeder.

This has glass sides and is so arranged that the student can see the bees feed.

As mentioned above, when making only an observation cover, a top cleat and under bar are not necessary. The first step is to discard these, leaving a narrow $1\frac{7}{8}$ in. slit in the cover.

A $\frac{1}{4}$ in. x $\frac{1}{8}$ in. rabbit is now cut in the upper, inner edge of the slope board. These are for the two large plates of glass to fit in. Next cut the side supports for the glass. These are 10 in. x $2\frac{5}{8}$ in. x 1 in. They have a $\frac{7}{8}$ in. x $\frac{3}{8}$ in. notch cut out of the two lower sides to fit in between the slope boards. Now, on the inner sides cut $\frac{1}{8}$ in. x $\frac{1}{8}$ in. slots $\frac{1}{4}$ in. from the edge to hold the glass. The last operation is to cut a pocket $1\frac{5}{8}$ in. wide x $\frac{7}{8}$ in. deep and recessed $\frac{1}{2}$ in. This is cut $\frac{1}{2}$ in. from either inner edge. A $1\frac{1}{2}$ in. length of T tin is placed in this to support the frame. To tie the perpendicular ends together a 20 in. x $\frac{7}{8}$ in. x $\frac{1}{4}$ in. strip is run from one upright to the other. Two are used and are to be nailed carefully. Two plates of 16 oz. glass $18\frac{1}{4}$ in. x $9\frac{1}{2}$ in. fit into the grooves just completed.

One cannot set up this portion of the cover. Use $1\frac{1}{2}$ in. screws instead of nails, three to each end of the slope boards, countersinking the heads slightly. To fasten the uprights drive three screws. Arrange them triangularly, two nearest the top and spaced about $1\frac{3}{4}$ in. apart. At about this point it is best to tack the queen-excluding zinc upon the under side of the cover directly under the opening. This must be purchased from a bee supply house. It should be at least $2\frac{1}{2}$ in. wide and $19\frac{1}{2}$ in. long. Slip in the glass, do not putty or fasten it. This completes the most important part of the modifications.

To make the cover one should first cut a piece of wood 20 in. x $3\frac{3}{8}$ in. x $\frac{1}{2}$ in. In the center of this $7\frac{1}{2}$ in. from the ends and $1\frac{3}{8}$ in. from the sides cut a 5 in. x $\frac{3}{8}$ in. slot. This allows the bees to come up into the feeder. Directly opposite this slot cut a rabbit on each side to hold the glass of the feeder. These are $5\frac{1}{8}$ in. x $\frac{1}{4}$ in. x $\frac{1}{8}$ in. Around the edge of the main cover nail 1 in. x $\frac{1}{4}$ in. strips of wood. Make the long ones $20\frac{1}{2}$ in. and the short ones $3\frac{1}{8}$ in.

The feeder is composed of four pieces of wood, 2 plates of 16 oz. glass, $5\frac{1}{4}$ in. x $4\frac{1}{4}$ in. and a cover. To make the passage for the bees to enter the feeder nail 5 in. x $3\frac{1}{4}$ in. x $\frac{1}{4}$ in. boards on each side of the slot. For the ends use parts 4 in. x $3\frac{3}{8}$ in. x $\frac{1}{2}$ in. Near the 4 in. edge ($\frac{1}{8}$ in. distant) cut an $\frac{1}{8}$ in. x $\frac{1}{8}$ in. groove to hold the glass sides. Nail the end pieces to the ends of the bee passage and to the top of the large cover. Now slide in the glass. To prevent leakage in the feeder a little melted wax or paraffine can be poured into both

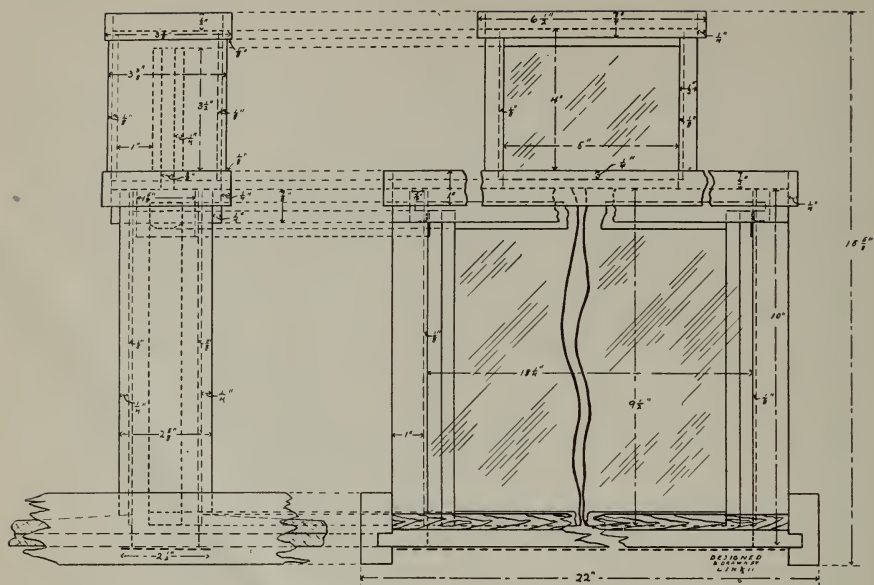


Fig. 3

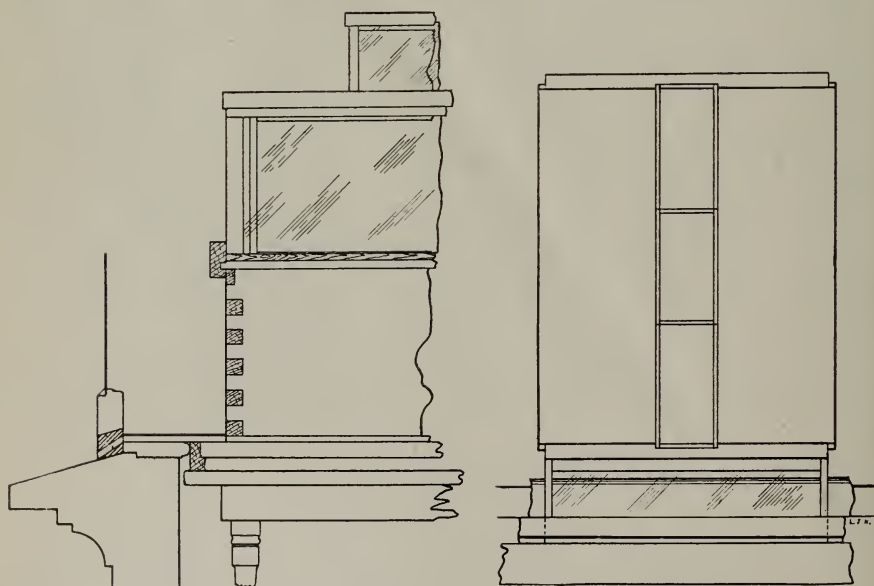


Fig. 4

pockets and the cover tipped about to allow the hot liquid to fill the cracks. There will be absolutely no leakage if one gives this operation a little care.

The cover for the feeder is 6 in. x $3\frac{1}{8}$ in. with $\frac{3}{4}$ in. x $\frac{1}{4}$ in. strips upon its edge. This necessitates cutting a $\frac{1}{4}$ in. x $\frac{1}{8}$ in. notch in the four upper corners of the ends of the feeder. The side strips for the feeder cover are $6\frac{1}{2}$ in. x $\frac{3}{4}$ in. x $\frac{1}{4}$ in., the ends are $3\frac{1}{8}$ in. x $\frac{3}{4}$ in. x $\frac{1}{4}$ in. Use light nails for these. Sandpaper the entire apparatus when it is finished.

If the carpenter has completed a neat piece of work, instead of painting the hive and observation cover the work can be varnished. This will give the hive a much better appearance when it is used entirely indoors. If it is used outside, paint, preferably white, will make the best sort of protection.

INSTALLING THE HIVE.

Figure 4 shows a method of setting up the hive. Set it upon a box or table in front of a window. An entrance through this can be made by fitting a piece of wood into the window casing and cutting a 15 in. x $\frac{1}{2}$ in. slot as indicated in the drawing. For a passage to the window lay $\frac{7}{8}$ in. x $\frac{3}{8}$ in. strips from the hive to it and lay on these a piece of glass 16 in. wide and as long as the distance between the hive entrance and the slit board. This is a simple arrangement, allowing one to see the bees entering and leaving their colony.

CARE OF THE BEES.

Lack of space does not permit a general discussion of the handling of bees. A very good idea of the subject can be obtained by consulting the works suggested in the bibliography.

Before attempting to handle bees, one must have a smoker (price about \$1). It is also a good plan for a beginner to have a bee veil and canvas gloves.

A colony of bees can be purchased for a nominal sum in practically every community in California.

When the bees are installed in their new home, select a frame with a little brood in it, place the queen upon the frame and set it in the observation section. Never smoke the bees any more than is sufficient to pacify them. Always darken all the windows save the one opposite the hive when carrying on manipulation indoors.

When the queen has filled the brood frame with eggs, put it in the center of the body of the hive and transfer the queen to a new frame

which is to take the place of the preceding one in the observation section. Change the frame every week, although it may not be filled with eggs. For the first few days the bees may not fill the observation section. Soon, however, they will recognize that the queen is confined; brood rearing will start, and all the labors of an active colony will be carried on before one's eyes.

Bees hibernate in the winter time. If you do not care to feed them place the queen in the body of the hive during this season.

For feeding syrup, use a mixture of half honey and half water or two parts sugar to one of water. Pour this into both sides of the feeder. It is very important to keep a small, thin float about the size of each pocket upon the syrup, so that the bees will not fall in. Always feed regularly. A small amount every day is best. Feeding is never necessary when the bees are gathering nectar.

Bees prefer to carry on their colony life in the dark. Cover the glass entrance with a thin board or cardboard. Pieces of the same material should be cut for the observation frame. They can be slipped up under the cover behind the cross straps. These will keep the hive dark and are easily removed.

When one has become proficient in the handling of the colony one may attempt queen rearing or use the observation portion for storage of honey or give the bees a starter and study comb production. Always keep the queen in the body of the hive when storing honey or making comb in the upper portion.

BIBLIOGRAPHY.

Suitable publications of the United States Department of Agriculture on Bee-keeping.

Farmers' Bulletin No. 59, "Bee Keeping," by Frank Benton, 1905, 48 pp., 19 figs. (Superseded by Farmers' Bull. No. 397.) Free.

Farmers' Bulletin No. 397, "Bees," by E. F. Phillips, Ph.D., 1910, 44 pp., 21 figs. A general account of the handling of bees. Free.

Circular No. 97, "The Brood Diseases of Bees," by E. F. Phillips, Ph.D., 1906, 5 pp. Free.

Bulletin No. 55, "The Rearing of Queen Bees," by E. F. Phillips, Ph.D., 1905, 32 pp., 17 figs. Price 5 cents.

Technical Series No. 18, "The Anatomy of the Honey Bee," by R. E. Snodgrass, 1910, 162 pp., 57 figs. Price 20 cents.

For free publications address the Secretary of Agriculture. The publications with price can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Suitable Standard Works.

Cheshire, Frank R., 1886, "Bees and Bee Keeping," 2 vols. Illustrated.

Comstock, Mrs. A. B., 1905, "How to Keep Bees," a handbook for beginners, pp. 222. Illustrated.

Cowan, T. W., 1908, "Wax Craft," pp. 172. Illustrated.

Doolittle, G., 1901, "Scientific Queen Rearing," pp. 126. Illustrated.

Hutchinson, W. Z., 1905, "Advanced Bee Culture," 330 pp. Illustrated.

Langstroth, L. L., 1904, Rev., "Langstroth on the Hive and Honey Bee," pp. 521. Illustrated.

Root, A. I. and E. R., 1908, "The A B C and X Y Z of Bee Culture," pp. 536. Illustrated.

Lyon, D. Everett, Ph.D., 1910, "How to Keep Bees for Profit," pp. 329. Illustrated.

Bee Magazines.

A. I. Root Co., Medina, Ohio, "Gleanings in Bee Culture," pp. 72. Semi-monthly. Illustrated.

Hutchinson, W. Z., Flint, Mich., "Bee Keepers' Review," pp. 30. Monthly. Illustrated.

Popular Works.

Maeterlink, Maurice, 1901, "The Life of the Bee," translated by Alfred Sutro, pp. 348.

Edwards, Tieckner, 1907, "Bee Master of Warrilow," pp. 64, Illustrated, 11. 1907, "Lore of the Honey Bee," pp. 281. Illustrated, 24.

Morley, Margaret, 1901, "The Bee People," pp. 77. Illustrated.

